

## IN MEMORY OF A SCIENTIST

ISAAK IL'ICH KITAIGORODSKII

On His 125th Birthday Anniversary (1888–1965)

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Translated from *Steklo i Keramika*, No. 4, pp. 3–5, April, 2013.



*“Engineering and art merge in the technology of glass and ceramics, while in the material itself and the articles made from it we find prose and poetry, food for the mind and heart. Is it possible not to be captivated by such a technology?”*

I. I. Kitaigorodskii

*Isaak Il'ich Kitaigorodskii, Professor, Honored Scientist and Technologist of the Russian Soviet Federated Socialist Republic, Laureate of the Lenin Prize and Laureate of the State Prize of the USSR, Doctor of Technical Sciences and authority in domestic glassmaking, made an enormous contribution to the advancement of glass science, creation of the glass industry in the USSR and organization of the training of highly trained cadres for the glass sector in the USSR. He was present at the inception in 1925 of the journal *Steklo i Keramika*, served on the first editorial board and successfully collaborated with the journal for many years not only as member of the board but also as author of many publications.*

I. I. Kitaigorodskii was born on April 15 (27), 1888 into the family of an office worker in the city of Kremenchug in Ukraine. In 1906, having successfully passed examinations without attending classes in a secondary school stressing science in Ekaterinoslav (Dnepropetrovsk), he entered the faculty (department) of chemistry at Kiev Polytechnic Institute, graduating in 1910. Having received a diploma Isaak Il'ich went to Moscow where he was accepted in the position of manager (technical head) of the Zaprudnenskii Glass Plant near Moscow, specializing in the manufacture of pharmaceutical glass containers and perfume bottles. The job at the plant proved to be very valuable. Here, the young engineer and technologist became trained in commercial glassmaking and his views as a scientist on the need to organize scientific research relevant to real manufacturing work aimed at solving real problems of contemporary and future technologies

were formed. I. I. Kitaigorodskii's future professional work was based on these principles.

After the revolution I. I. Kitaigorodskii actively participated in the restoration and reconstruction of the country's glass industry, which was destroyed by the civil war, taking important positions in the economic organs of the Soviet republic: Board of Glavsteklo SCNE, Glavsilikat, Glass Industry Syndicate, commission on the mechanization of the glass industry; he worked in the Supreme Council on the National Economy (SCNE). He was an author and speaker at the SCNE for the first five year plan for the development of the domestic glass industry, organizer of the reconstruction and planning of extant and new glass production operations, director of and participant in the startup of the first mechanized glass plants in the country in Donbass (Konstantinovka), Dagstan (Derbent) and Podmoskov'e. In this important work Isaak Il'ich relied on, first and foremost, advanced world technologies and on personal experience acquired during

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long assignments in glass enterprises in Germany, France, Belgium, England and USA (1925 – 1926). I. I. Kitaigorodskii combined intense organizational and engineering work with scientific work at the State Experimental Glass Institute (later the State Glass Institute).

Starting in 1926, in parallel with scientific and industrial work, Isaak Il'ich did pedagogical work at the Moscow Institute of the National Economy, Moscow Institute of Silicate and Construction Materials and, from 1933 to the end of his life, in the faculty of glass technology, which was started at his initiative, at the D. I. Mendeleev Moscow Chemical Technology University (now the Faculty of Chemical Technology of Glass and Sitals at the D. I. Mendeleev Russian Chemical Technology University).

For more than 30 years Isaak Il'ich headed the department and led its work, devoting efforts, time and talent to its development and transformation into a leading scientific and educational center in the country in the field of glassmaking. His pedagogical talent, ability to attract and enthrall student audiences with any subject and capability of uniting talented scientists around himself were fully manifested in his work in the department. More than 1000 engineers and technologists, more than 70 candidates and doctors of science were trained under I. I. Kitaigorodskii's leadership. Many of his students became well-known scientists, heads of scientific-research institutes and industrial enterprises. Among them are Hero of Socialist Labor Prof. M. S. Aslanova, Laureates of the Lenin Prize Prof. N. M. Pavlushkin, I. D. Tykachinskii, K. T. Bondarev and F. G. Solinov, Laureate of State Prizes Academician of the Russian Academy of Sciences P. D. Sarkisov, Prof. A. I. Berezhnoi, B. G. Varshal, V. F. Solinov, S. S. Solntsev, A. G. Shabanov and R. Ya. Khodakovskaya and many others. These researchers and engineers comprised the Moscow school of glassmakers recognized worldwide.

I. I. Kitaigorodskii left a large scientific legacy in the form of monographs, brochures and articles. The textbook *Technology of Glass*, co-authored with leading scientists in the glass industry and published with I. I. Kitaigorodskii as the general editor in 1939, was re-printed four times and translated into foreign languages. The *Handbook of Glass Production* published in two volumes with I. I. Kitaigorodskii and S. I. Sil'vestrovich as the editors came out in 1963. These books became desk references for many generations of glassmakers.

I. I. Kitaigorodskii's scientific interests were closely associated with the general development of the glass industry in Russia. They touched upon the expansion of the raw materials resources for glassmaking (use of rocks, lacustrine clays, pulverized silica, furnace slag and other industrial wastes in glassmaking), intensification of glassmaking and glass production (development of new types of glassmaking furnaces and new methods of glassmaking) and improvement of the technological and operational properties of sheet glass (development of five-component aluminum-magnesia

sodium-calcium-silicate glass for mechanized production using the at that time advanced Fourcault method of vertical pulling). The adoption of the results of these works in industry was recognized by the 1941 State Prize.

I. I. Kitaigorodskii's large body of research is devoted to developing the theoretical principles and practice of obtaining colored and opaline glasses. The results of this work are presented in I. I. Kitaigorodskii's monograph *Coloring and Opacification of Glass* and have been implemented in the colored glass at the Moscow subway (Novoslobodskaya station), ruby stars in the Moscow Kremlin, Fresnel lenses, light filters with prescribed spectral characteristics and uviole glasses used in illumination engineering.

During WWII Isaak Il'ich's research concerned the country's needs for high-strength glass, chemically stable medical glass for storing blood and pharmaceutical preparations, and glass-attack-resistant refractories.

One of the main scientific directions that I. I. Kitaigorodskii and his colleagues and students developed over the course of many years is related with the development of fundamentally new silicate and oxide materials for different purposes. Among the developments in this direction — lightweight heat- and sound-insulating material for construction — which are still important and urgent today is foam glass, for which in 1950 the group of authors headed by I. I. Kitaigorodskii was awarded the State Prize. Another unique material was coauthored in subsequent years by I. I. Kitaigorodskii and his colleagues in the department he headed — sintered corundum, or microlite, surpassing in hardness and durability all nonmetallic materials known at the time, obtained by ceramic technology. This material, which is irreplaceable in the fabrication of metal-cutting tools, was adopted at the Moscow Combine of Hard Alloys. World records in metal cutting speed were set on lathes with microlite cutters.

In 1950s – 1960s work on the synthesis of a new class of materials based on glass, called sital in our country and glass ceramics in other countries, was started in the USSR under I. I. Kitaigorodskii's leadership. The coexistence in sital of very small crystal particles of different crystalline phases cemented by a thin glassy interlayer opens extremely wide possibilities for creating materials with a complex of the most diverse, pre-planned properties. Forcing the development of this class of materials, I. I. Kitaigorodskii devoted a great deal of attention to building a fundamental base for sital technology — the theory of directed crystallization of glass. His ideology, the theoretical precepts developed, the extensive experimental material and the intense organizational work were crowned with great success — in 1959 large parts made from sitals with low thermal expansion and optimal dielectric properties for supersonic aircraft were obtained under industrial prototype conditions at the Avtosteklo plant in Konstantinov. Subsequently, in 1966, the first production line in the world for the production of sheet glass ceramic material based on furnace slag — slag sital — was started up

in the same plant. In 1963 I. I. Kitaigorodskii was awarded the Lenin Prize for the development of sitals.

I. I. Kitaigorodskii's fundamental ideas were the kernels from which today's scientific directions in the faculty of chemical technology of glass and sitals were formulated. His students and followers are continuing and developing the work on the synthesis of and research on new types and forms of glassy, glass ceramic and composite materials, enamels and coatings used in the most diverse fields. Many theoretical approaches formulated by Isaak Il'ich remain the scientific foundation for these developments.

Isaak Il'ich Kitaigorodskii was not only an outstanding scientist, engineer-technologist and teacher but he also had a striking multifaceted personality and was endowed with many talents. He loved music passionately and was himself an excellent pianist, painting enthralled him from youth to the end of his life, and he was fluent in several foreign languages. However, the core of his life was scientific research and love of glass. Isaak Il'ich's emotional and artistic nature could not remain indifferent to the beauty of this surprising and mysterious material. Isaak Il'ich kept this passion to the last days of his life.